

Tare/tang dyrking i Norge: status og planer fremover

ASuReMacro verkstova
15. mars 2023
Øravik, Færøyene

Gunhild Borgersen, NIVA

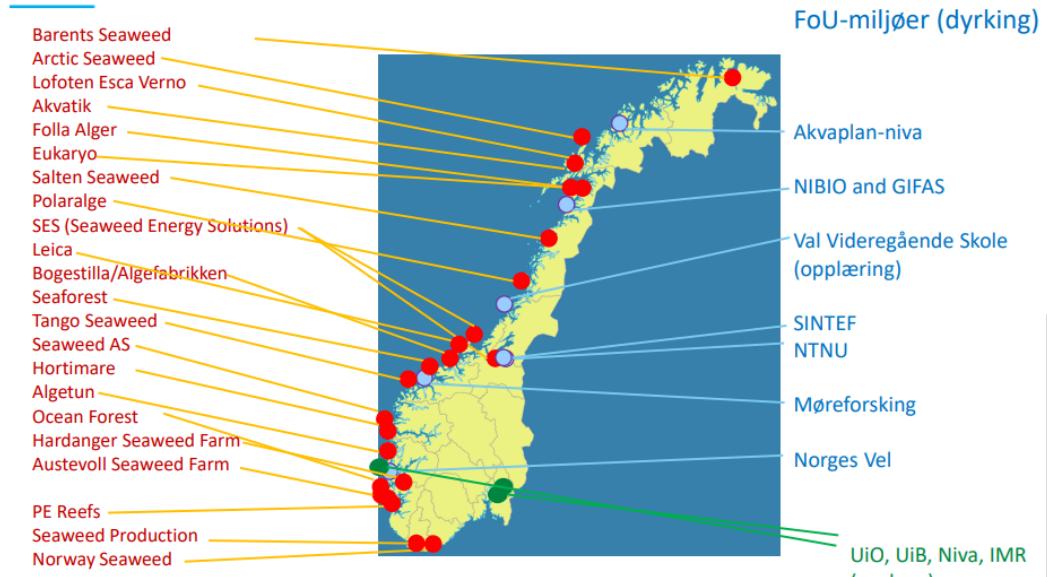
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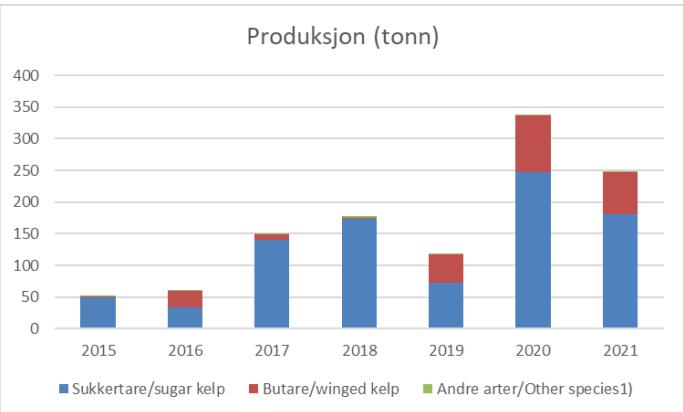
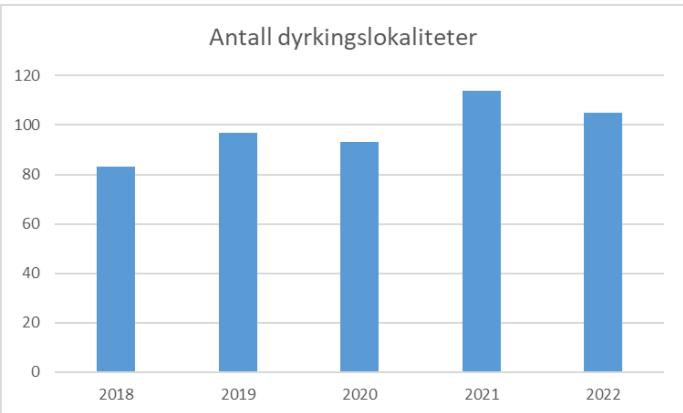
Gunhild Borgersen, NIVA

Tare/tang dyrking i Norge

Taredyrkere i Norge (2019)



250 tonn biomasse i 2021



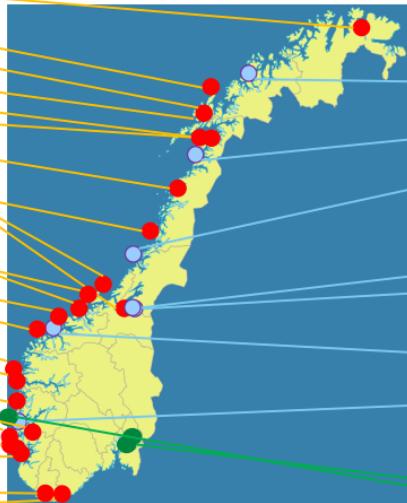
20 mill
tonn¹

Tare/tang dyrking i Norge

Taredyrkere i Norge

Barents Seaweed
Arctic Seaweed
Lofoten Esca Verno
Akvatik
Folla Alger
Eukaryo
Salten Seaweed
Polaralge
SES (Seaweed Energy Solutions)
Leica
Bogestilla/Algefabrikken
Seaforest
Tango Seaweed
Seaweed AS
Hortimare
Algetun
Ocean Forest
Hardanger Seaweed Farm
Austevoll Seaweed Farm

PE Reefs
Seaweed Production
Norway Seaweed



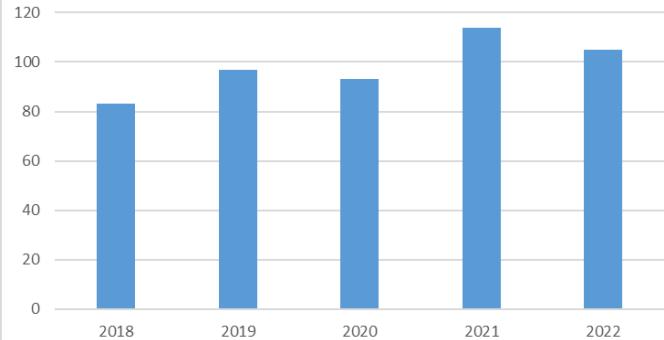
250 tonn biomasse i 2021

FoU-miljøer (dyrking)

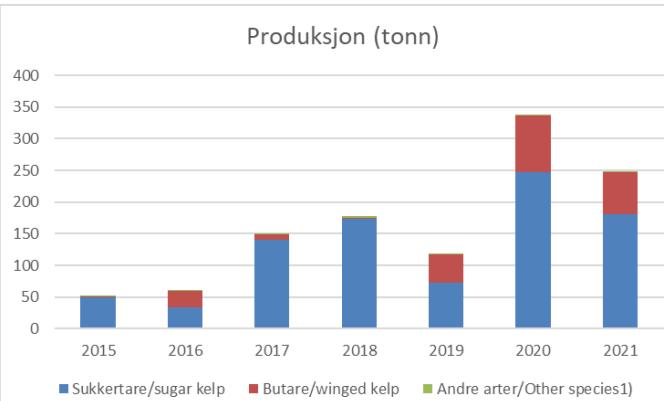
Akvaplan-niva
NIBIO and GIFAS
Val Videregående Skole (opplæring)
SINTEF NTNU
Møreforskning
Norges Vel

UiO, UiB, Niva, IMR (ecology)

Antall dyrkingslokaliteter



Produksjon (tonn)

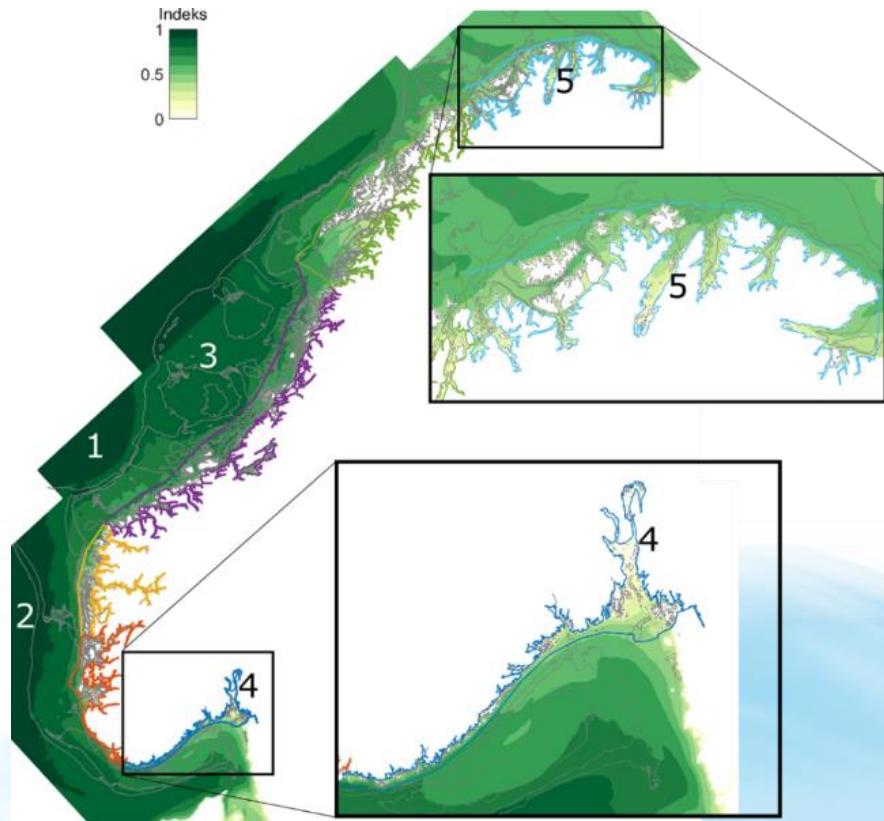
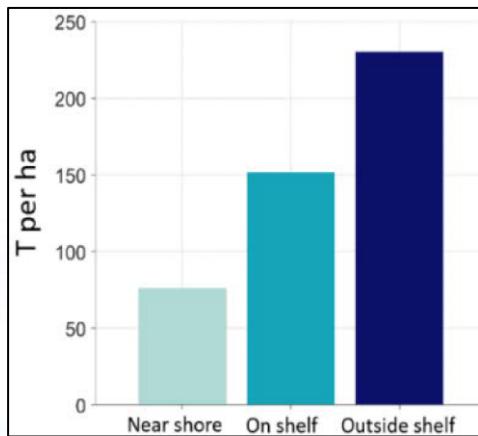


2050

¹Olafsen et. al., 2012

Dyrkingspotensial i Norge

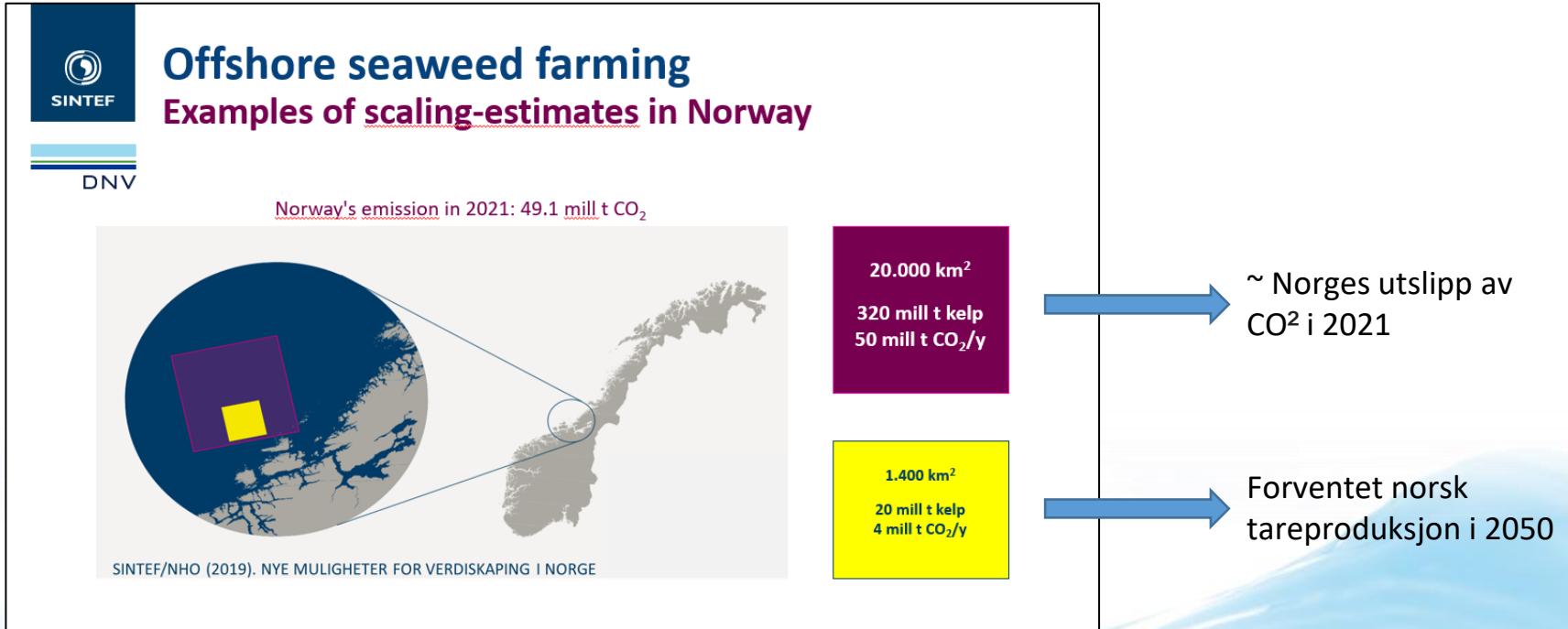
- Høyest potensiale for tangdyrkning offshore



Broch et al., 2019 (<https://doi.org/10.3389/fmars.2018.00529>)

Forbord et al., 2020 (<https://doi.org/10.1007/s10811-020-02038-y>)

Dyrkingspotensial i Norge





SINTEF



DNV



Dyrking av sukkertare, en naturbasert metode for aktiv karbonfangst

Seaweed Carbon Solutions – a joint industry project



Teknologi for et bedre samfunn



Seaweed Carbon Solutions

Joint Industry Project

GOAL: Develop **scalable** technology for open ocean **seaweed-CDR** (carbon dioxide removal) with a potential for removal of **1 mill ton CO₂ in 2030** by climate positive products or solutions.

- Test **sea farm modules** under offshore conditions
- Test **sinking at sea and biochar on land** as carbon storage
- Assess positive and negative **environmental impacts**
- Quantify actual and potential **net CO₂-removal**
- Outline seaweed **CO₂-offset** mechanism and business cases



PILOT 2022-2024

5 M€ budget

Option for DEMO 2025-2027

Open for more partners



Possible CDR solution

Biochar made from seaweed for different carbon storing applications

Seaweed Carbon Solutions
Joint Industry Project



Production potential kelp biochar:

- 600-800 tons per km² sea surface

Possible CDR solution

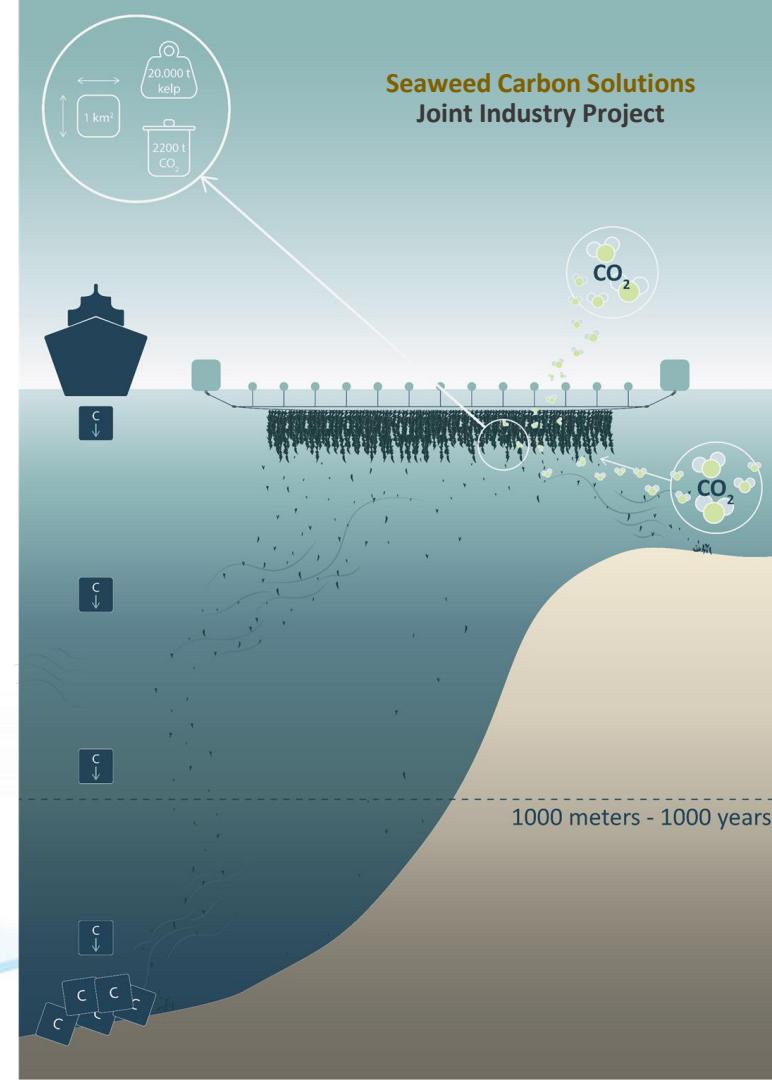
Sinking of kelp biomass for long term storage in sediments

Deponering av (store) mengder tarebiomasse på havbunnen kan gi

- dårlig økologisk tilstand
- oksygenmangel
- endring i naturlig biologisk mangfold
- spredning av uønskede arter og gener

Må overvåke miljøeffekter

Seaweed Carbon Solutions
Joint Industry Project





Seaweed Carbon Solutions

Joint Industry Project

Timeline – JIP & Industrial development

JIP Seaweed-CDR Pilot

Phase I: Proof of concept

Licencing - Design and Operation – Environment - Offset
5-7 M€

0,1 km² Module
1000 t Seaweed
100 t CO₂-Capture/Y

100.000
NOK/t
+ Storage

2022

2023

2024

JIP-Option Demonstration

Phase II: Upscaling & documentation

Technology - Environment - Offset
15-20 M€

1 km² (10 Modules)
10.000 t Seaweed
1.000 t CO₂-Capture

X 10

25.000
NOK/t
+ Storage

2025

2026

2027

Industrialisation

Phase III: Commercialisation

10 km²
100.000t Seaweed
10.000 t CO₂/Y

X 10

10.000
NOK/t

1000 km²
10 Mt Seaweed
1-2 Mt CO₂/Y

X 100

1000
NOK/t

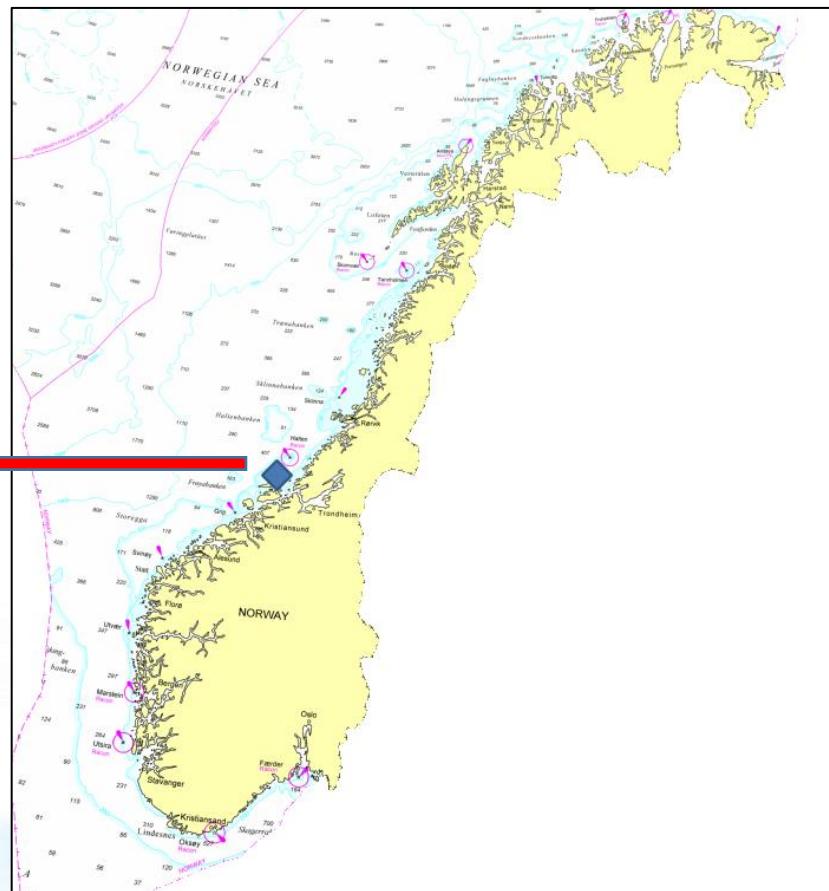
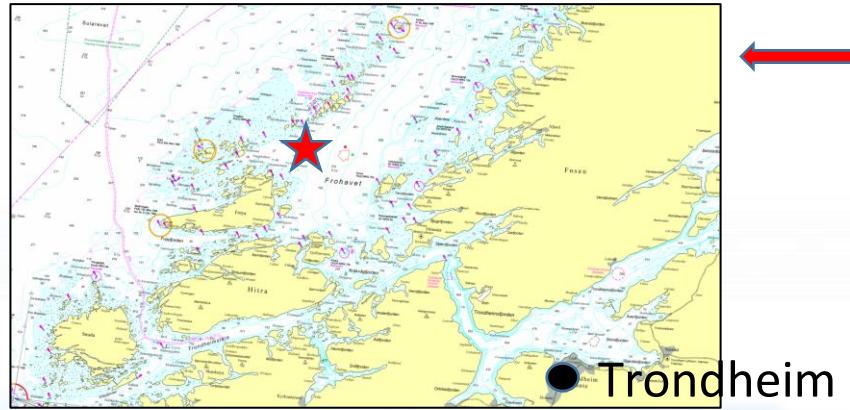
2028

2029

2030

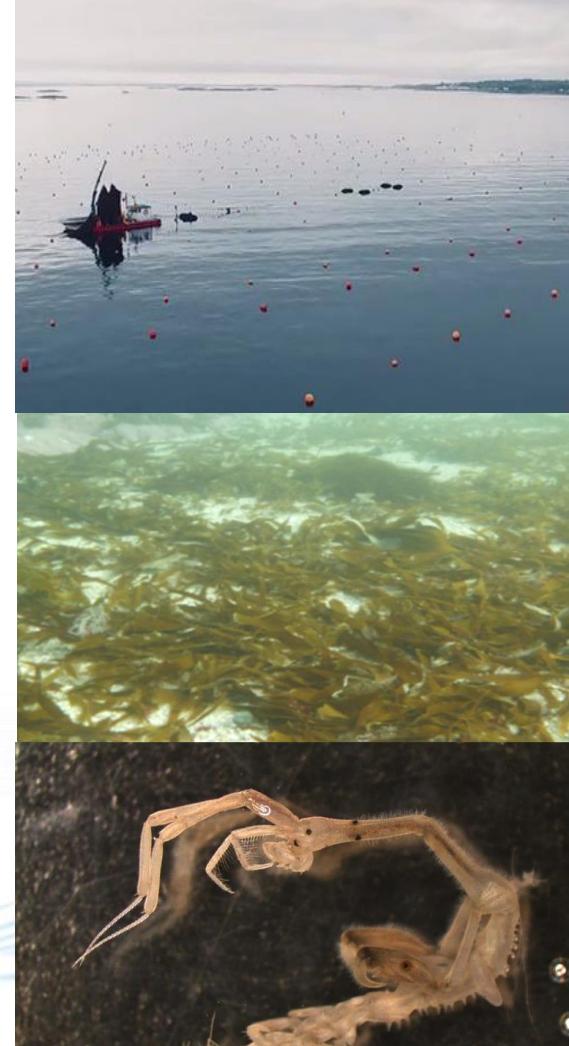
Offshore pilotanlegg

Det søkes om etablering av sjøanlegg på 650 da for inntil 800 tonn biomasseproduksjon. Totalt areal inkludert fortøyningsareal er 800 da



Environmental impact

- Monitoring of the effects of dissolved nutrients removal by the large scaled biomass production.
- Monitoring of the seaweed farm as a temporary habitat.
- Evaluation of effects on the benthic ecosystem under the farm.
- Quantify particulate organic carbon (POC) released from farms
- **Base-line surveys prior to production**



GP SEAWEED

New products from cultivated seaweed
for blue-green value-chains
(2023-2025)



GP Seaweed

New products from cultivated seaweed for blue-green value-chains



Bulk food ingredient

- Preservation
- Iodine reduction
- Biomass sorting

Functional feed ingredient

- Polysaccharides
- Fermentation
- Gut health

Tailored kelp biomass

Ecosystem interactions and climate assessment

Packaging materials

- Bioplastic
- Films and rigid materials

Soil improvement & carbon storage

- Biochar
- Functional compounds



Felleskjøpet CircleGreen



Ecosystem interactions and climate assessment

- Assessment of biodiversity, alien and threatened species associated with kelp farms
- Disease in seaweeds – effects on production and potential environmental stressor
- Reduced GHG emissions – quantify carbon removal
- CO₂-emissions related to the processing and production processes
- Mathematical modelling



Oppsummering

- Taredyrking i Norge: oppskaleres og flyttes offshore?
- Økt produksjon krever store arealer, og risiko for negative miljøkonsekvenser øker
- Taredyrking kan være et positivt klimatiltak
- Takk for meg!